Appendix J

Energy Analysis

Content

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APPENDIX J
ENERGY ANALYSIS

J.1 Background

The Canadian National Railway Company and Grand Trunk Corporation (collectively, CN or the Applicants) are seeking authorization from the Surface Transportation Board (Board) to acquire control of EJ&E West Company, a wholly owned non-carrier subsidiary of Elgin, Joliet and Eastern Railway Company (EJ&E). Appendix J summarizes the Board's Section of Environmental Analysis (SEA) methods for identifying and evaluating the potential effects of the proposed acquisition on energy transport, consumption, and overall efficiency.

J.2 Energy Methodology

The Applicants are proposing to acquire control of EJ&E West Company and to use the EJ&E rail line to connect all five of CN's rail lines in Chicago (the Proposed Action). The SEA evaluated the potential effects of the Proposed Action and other alternatives on energy usage. The transaction would result in rail-to-rail diversion of traffic which, depending on the relative efficiency of future routes for this freight compared to existing routes, may result in a change (decrease or increase) in total fuel usage. However, additional capacity created as a result of the Proposed Action could create a net increase in freight hauled by rail compared to freight hauled by trucks. In this case, a net decrease in energy consumption may be realized.

J.2.1 Energy Use Caused by Proposed Changes in Rail Line Operations

The net change in energy use caused by proposed changes in rail line operations was developed based on a comparison of changes between current and projected annual fuel use on the CN and EJ&E rail line segments. SEA also considered fuel use changes for other carriers operating on the CN Rail Line and EJ&E Rail Line segments. Additionally, SEA considered the change in fuel use resulting from reduced idling time by CN trains. For these fuel use changes, which were provided in imperial gallons per day (Applicants 2008), the data were converted to U.S. gallons, and then multiplied by 365 to give values in units of U.S. gallons per year. This value was multiplied by a conversion factor (139,000 Btu/gal) and divided by 1 million to yield MMBtu units.[1]

J.2.2 Energy Efficiency of Proposed Changes in Rail Line Operations

The Applicants provided estimates of changes in energy efficiency as a result of the Proposed Action. In spite of projected increases in direct fuel use by CN, and therefore an increase in energy use, the energy efficiency of the system, measured in gallons per gross ton mile, would be substantially improved as a result of the Proposed Action. This is the result of bigger trains being used under the Proposed Action as compared with the No Action Alternative. Efficiencies were calculated by dividing the fuel use by the gross ton-miles per day (gtm/d).

J.2.3 Energy Use by Vehicle Idling at Highway/Rail At-Grade Crossings

The methodology for determining fuel use caused by motor vehicles idling at crossings uses the procedure for calculating the total annual vehicle delay hours found in Section 4.3.1, Regional and

[1] Diesel energy content is assumed to equal to 139,000 Btu/gal (Energy Information Administration 2008).

Local Highway Systems. SEA used 2007 ADTs to calculate existing traffic delays and county-specific growth factors to develop ADTs at each public at-grade crossing for the analysis year.

SEA calculated both gasoline and diesel fuel use from annual motor vehicle delays at a crossing by multiplying the total vehicle delay hours (Dan) by the percentage of gasoline and diesel vehicles in the default setting for national fleet average mix set out in the U.S. Environmental Protection Agency's (EPA) MOBILE6.2 vehicle emission modeling software (EPA 2003b). For 2015, the mix is 91.1 percent gasoline and 8.9 percent diesel engines. Total annual delay hours were multiplied by these ratios and fuel consumption rates (0.5 gallons per hour of idling) to give an annual fuel usage resulting from all vehicles idling because of delays at public at-grade intersections (Clark et al. 2005; Gaines et al. 2006). These values were multiplied by a conversion factor (124,000 Btu/gal for gasoline, 139,000 Btu/gal for diesel) and divided by 1 million to yield MMBtu units.

Attachment J1

Energy Calculation Spreadsheets

Energy Operations
Original Data

	Fuel Use per Day (Imperial Gal)		Total per Day (Imperial Gal)	Fuel Use per Day (US Gal)		Total per Day (US Gal)	Fuel Use per Year (US Gal)		Total per Year (US Gal)	Usage (MMBtu)
	CN Trains on EJ&E	CN Trains on CN and Other		CN Trains on EJ&E	CN Trains on CN and Other		CN Trains on EJ&E	CN Trains on CN and Other		Diesel
No Action (any year)	366	11,317	11,683	439	13,591	14,031	160,377	4,960,826	5,121,203	711,847
Action (any year)	15,630	1,704	17,334	18,772	2,046	20,818	6,851,706	746,957	7,598,663	1,056,214
Net Change (any year)	*15,264*	*-9,613*	*5,652*	*18,332*	*-11,545*	*6,788*	*6,691,329*	*-4,213,869*	*2,477,460*	*344,367*

Fuel Use by Other Carriers on All Lines	Fuel Use per Day (Imperial Gal)		Total per Day (Imperial Gal)	Fuel Use per Day (US Gal)		Total per Day (US Gal)	Fuel Use per Year (US Gal)		Total per Year (US Gal)	Usage (MMBtu)
	Other Trains on EJ&E	Other Trains on CN		Other Trains on EJ&E	Other Trains on CN		Other Trains on EJ&E	Other Trains on CN		Diesel
No Action (any year)			0	0	0	0	0	0	0	0
Action (any year)			0	0	0	0	0	0	0	0
Net Change (any year)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Idling Fuel Use by CN Trains on All Lines	Idling Fuel Use per Day (Imperial Gal)		Total per Day (Imperial Gal)	Idling Fuel Use per Day (US Gal)		Total per Day (US Gal)	Idling Fuel Use per Day (US Gal)		Total per Year (US Gal)	Usage (MMBtu)
	CN Trains on EJ&E	CN Trains on CN and Other		CN Trains on EJ&E	CN Trains on CN and Other		CN Trains on EJ&E	CN Trains on CN and Other		Diesel
No Action (any year)			0	0	0	0	0	0	0	0
Action (any year)			0	0	0	0	0	0	0	0
Net Change (any year)	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Gasoline = 124,000 Btu/gal; Diesel = 139,000 Btu/gal per the Energy Information Administration.
http://www.eia.doe.gov/basics/conversion_basics.html

Energy Operations
Revised Data

Fuel Use by Active CN Trains on All Lines	Fuel Use per Day (Imperial Gal)		Total per Day (Imperial Gal)	Fuel Use per Day (US Gal)		Total per Day (US Gal)	Fuel Use per Year (US Gal)		Total per Year (US Gal)	Usage (MMBtu)
	Active CN Trains on EJ&E	Active CN Trains on CN and Other		Active CN Trains on EJ&E	Active CN Trains on CN and Other		Active CN Trains on EJ&E	Active CN Trains on CN and Other		Diesel
No Action (any year)	366	11,317	11,683	440	13,592	14,031	160,442	4,960,977	5,121,418	711,877
Action (any year)	14,133	1,896	16,029	16,974	2,277	19,251	6,195,413	831,140	7,026,553	976,691
Net Change (any year)	*13,767*	*-9,421*	*4,346*	*16,534*	*-11,315*	*5,220*	*6,034,971*	*-4,129,837*	*1,905,134*	*264,814*

Fuel Use by Foreign Carriers	Fuel Use per Day (Imperial Gal)		Total per Day (Imperial Gal)	Fuel Use per Day (US Gal)		Total per Day (US Gal)	Fuel Use per Year (US Gal)		Total per Year (US Gal)	Usage (MMBtu)
	Foreign Trains Active	Foreign Trains Delay		Foreign Trains Active	Foreign Trains Delay		Foreign Trains Active	Foreign Trains Delay		Diesel
No Action (any year)	2,803	267	3,070	3,366	321	3,687	1,228,737	117,043	1,345,781	187,063
Action (any year)	981	10	991	1,178	12	1,190	430,036	4,384	434,420	60,384
Net Change (any year)	*-1,822*	*-257*	*-2,079*	*-2,188*	*-309*	*-2,497*	*-798,701*	*-112,660*	*-911,361*	*-126,679*

Idling Fuel Use by Delayed CN Trains on All Lines	Idling Fuel Use per Day (Imperial Gal)		Total per Day (Imperial Gal)	Idling Fuel Use per Day (US Gal)		Total per Day (US Gal)	Idling Fuel Use per Day (US Gal)		Total per Year (US Gal)	Annual Energy Usage (MMBtu)
	Delayed CN Trains on EJ&E	Delayed CN Trains on CN and Other		Delayed CN Trains on EJ&E	Delayed CN Trains on CN and Other		Delayed CN Trains on EJ&E	Delayed CN Trains on CN and Other		Diesel
No Action (any year)	0	1,317	1,317	0	1,582	1,582	0	577,327	577,327	80,248
Action (any year)	249	241	490	299	289	588	109,153	105,646	214,799	29,857
Net Change (any year)	*249*	*-1,076*	*-827*	*299*	*-1,292*	*-993*	*109,153*	*-471,681*	*-362,528*	*-50,391*

Gasoline = 124,000 Btu/gal; Diesel = 139,000 Btu/gal per the Energy Information Administration.
http://www.eia.doe.gov/basics/conversion_basics.html

Energy Delay Summary - for App

	Hours Idling on EJE Lines (D_{an})	Hours Idling on CN Lines (D_{an})	Total Hours Idling on All Lines	Vehicles by Fuel Type		Annual Fuel Usage (gallons)		Annual Energy Usage (MMBtu)	
				Gasoline	Diesel	Gasoline	Diesel	Gasoline	Diesel
Existing (2007)	86,610	491,597	578,206	91.3%	8.7%	263,864	25,210	32,719	3,504
No Action (2015)	102,103	582,706	684,809	91.1%	8.9%	312,067	30,337	38,696	4,217
Action (2015)	752,843	116,823	869,666			396,307	38,526	49,142	5,355
Net Change (2015)	*650,740*	*-465,882*	*184,857*			*84,239*	*8,189*	*10,446*	*1,138*

Fuel consumption while idling is approximately 0.5 gallons per hour of idling.

Gasoline = 124,000 Btu/gal; Diesel = 139,000 Btu/gal per the Energy Information Administration.

http://www.eia.doe.gov/basics/conversion_basics.html